THE PROGRESS OF SCIENCE

CURRENT COMMENT

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Science Service

REWARDS FOR WORKING INSIDE THE ATOM

Two Englishmen, one Dane and one German, are the winners of Nobel prizes in physics and chemistry for 1921 and 1922. The names just announced from Stockholm are Albert Einstein, of Berlin; Neils Bohr, of Copenhagen; Frederick Soddy, of Oxford, and Francis William Aston, of Cambridge. This is a striking illustration of the unity of science in spite of national divisions, for these four scientists have been in unconsidered cooperation trying to solve the same question, the most fundamental problem of the universe, what is the atom made of.

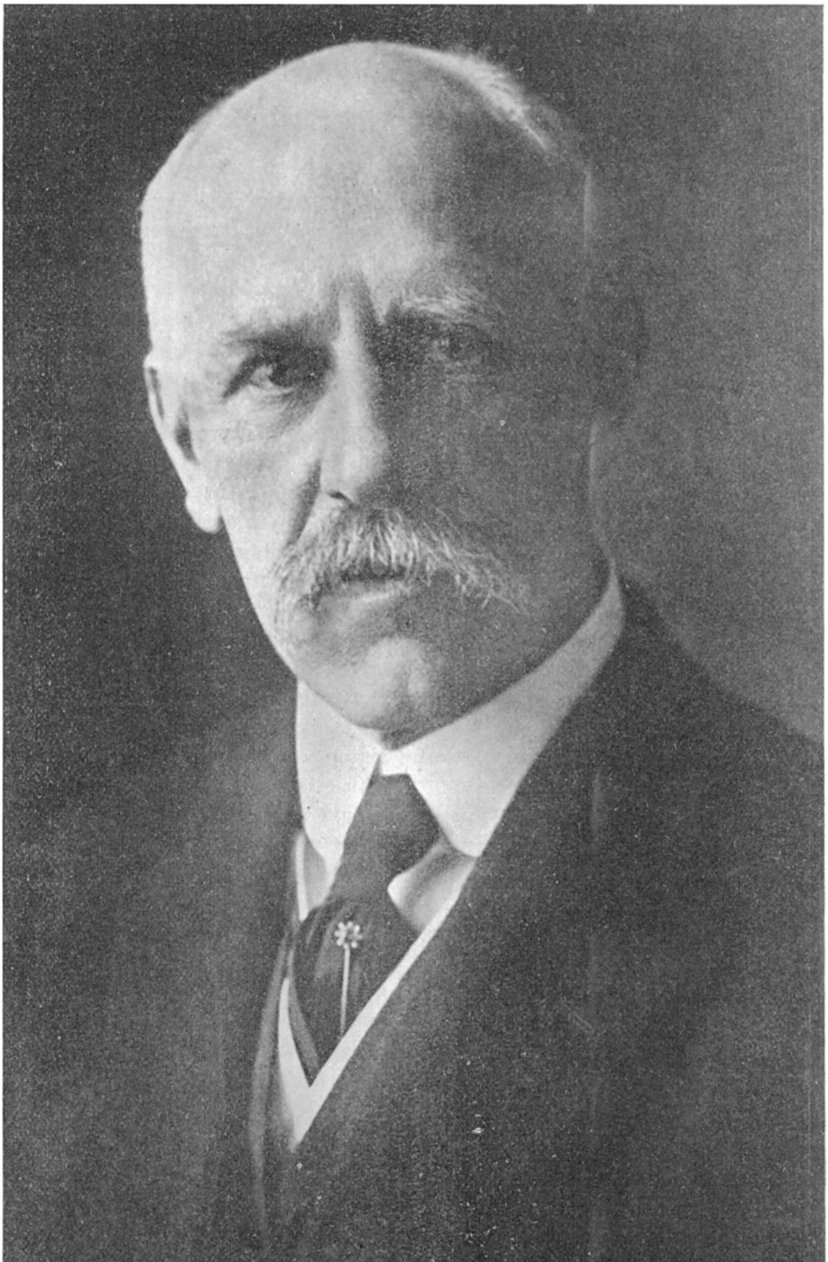
The atom was originally supposed to be the smallest thing possible, the ultimate unit of the universe. The ancient Greeks, who were the first to think about the question, concluded that if you kept on cutting up matter into smaller and smaller pieces you must come at length to something too small to be further sub-divided, so they called this smallest of all possible particles the ''atom'' which means ''uncutable.'' The modern chemist took over this old Greek idea to serve for the combining weights of the elements and likewise assumed that the atom was the limit.

But early in the present century, Professor J. J. Thomson, of Cambridge, found radioactive matter giving off particles more than a thousand times smaller than the smallest atom, and for this discovery he received the Nobel prize of 1905. This opened up a new field of research that has been diligently prosecuted ever since, especially by British scientists. Professor Soddy has not only done a large part of this work but he has given a good popular account of what it means in his book, ''Science and Life.''

Chemists used to suppose that all the atoms of the same element were exactly alike in weight and every other way, wherever it came from, but this fixed idea has been upset. Soddy found, for instance, that lead from thorium ores is eleven per cent. heavier in its atomic weight than lead from uranium ores. Soddy named these different forms ''isotopes.'' What are listed in chemical textbooks as atomic weights and were supposed to be unvarying turn out to be in many cases averages of several isotopes. Mercury, for instance, which is listed as having an atomic weight of 200.5 consists of six isotopes with weights varying from 197 to 204.

Aston devised an ingenious way of making the atoms record their own atomic weights. He drives a stream of positively charged particles between the poles of a powerful magnet which deflects them in the degree of their relative weights. When the dividing streams strike a photographic plate they leave their tracks and from these the mass of the various isotopes can be determined. Chlorine has always been a puzzle to chemists because its atomic weight figured 35.46 instead of a whole number. But subjected to the scrutiny of Aston's apparatus it is found to be a mixture of two kinds of chlorine atoms, one weighing exactly 35 and the other exactly 37.

The Scandinavian scientist, Bohr, was the first to venture on a picture of the new fashioned atom. We had



DR. FRIDJOF NANSEN

The distinguished Norwegian Arctic explorer and man of science, who has recently been occupying himself with the relief of sufferers from the Russian famine and is now engaged in similar work in Asia Minor.

been accustomed to think of atoms as round hard balls, but according to Bohr they are more like miniature solar systems with a positive electrical nucleus in the center and one or more negative electrical particles, called "electrons," revolving around it at tremendous speed.

Here is where Einstein comes in, for, while the planets moving majestically in their orbits obey Newton's law of gravitation, the electrons, which travel almost as fast as light, deviate from Newton's law in proportion to their speed and follow the formula of Einstein instead. According to Newton the mass of a body remains the same whatever its motion. According to Einstein, the mass increases with its velocity. The difference between them is inconsiderable for any ordinary speed, but when we are dealing with electrons moving at the rate of 100,000 miles a second it becomes important. The public has associated Einstein exclusively with astronomy because his theory has been tested at a time of eclipse, but the theory of relativity has applications quite as revolutionary and much more practical in earthly chemistry and physics.

HOW THE CHEMIST MOVES THE WORLD

THE chemist provides the motive power of the world, the world of man, not the inanimate globe. Archimedes said he could move the world if he had a long enough lever. The chemist moves the world with molecules. The chemical reactions of the consumption of food and fuel furnish the energy for our muscles and machines. If the chemist can only get control of the electron, he will be in command of unlimited energy. For in this universe of ours power seems to be in inverse ratio to size and the minutest things are mightiest.

When we handle particles smaller than the atom we can get behind th elements and may effect more marvellous transformations than ever. The smaller the building blocks the greater the variety of buildings that can be constructed. The chemistry of the past was a kind of cooking. The chemistry of the future will be more like astronomy; but it will be a new and more useful sort of astronomy, such as an astronomer might employ if he had the power to rearrange the solar system by annexing a new planet from some other system or expediting the condensation of a nebula a thousand times.

The chemist is not merely a manipulator of molecules; he is a manager of mankind. His discoveries and inventions, his economies and creations, often transform the conditions of ordinary life, alter the relations of national power, and shift the currents of thought, but these revolutions are effected so quietly that the chemist does not get the credit for what he accomplishes, and indeed does not usually realize the extent of his sociological influence.

For instance, a great change that has come over the world in recent years and has made conditions so unlike those existing in any previous period that historical precedents have no application to the present problems, is the rapid intercommunication of intelligence. Anything that anybody wants to say can be communicated to anybody who wants to hear it anywhere in all the wide world within a few minutes, or a few days, or at most a few months. In the agencies by which this is accomplished, rapid transit by ship, train or automobile, printing, photography, telegraph, and telephone, wired or wireless, chemistry plays an essential part, although it is so unpretentious a part that it rarely receives recognition. For instance, the expansion of literature and the spread of enlightenment, which put an end to the Dark Ages, is ascribed to the invention of movable type by Gutenberg, or somebody else, at the end of the four-